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BEHAVIOR OF SAND-ASPHALT GROINS AT OCEAN CITY, MARYLAND,(U)
MAY 59 R A JACHOWSKI

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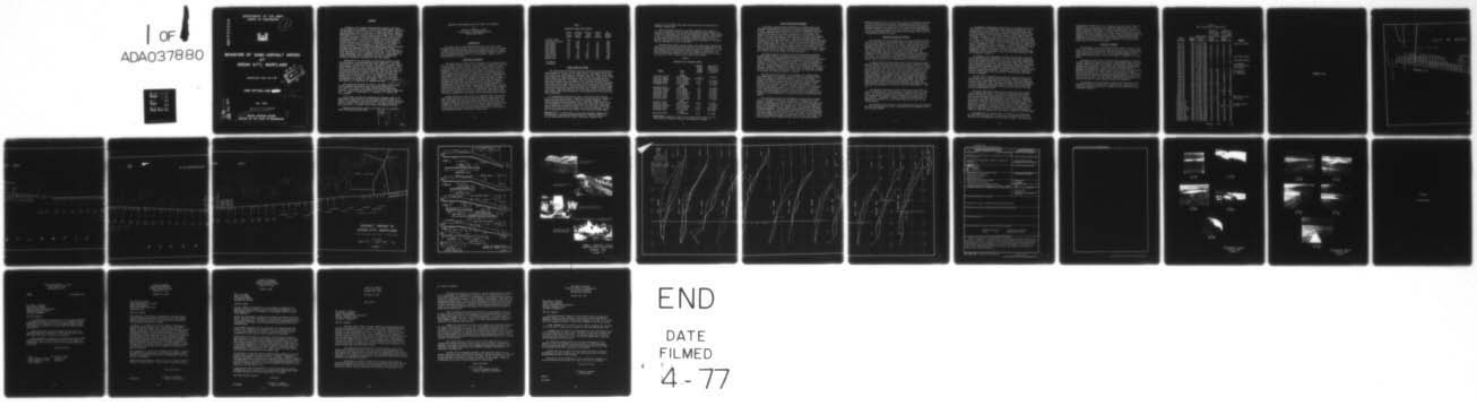

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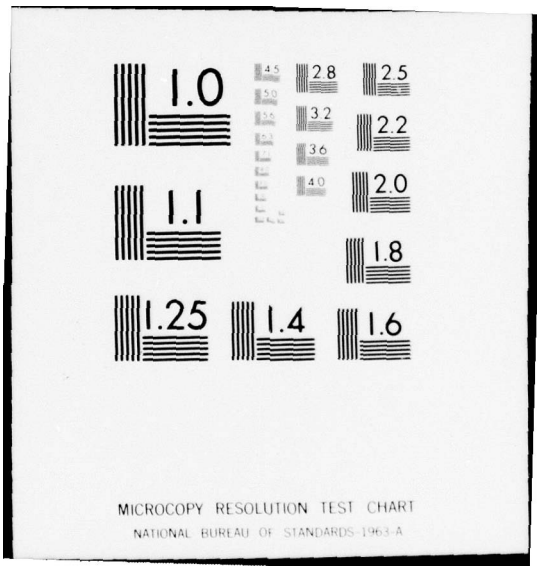
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DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS

BEHAVIOR OF SAND-ASPHALT GROINS AT OCEAN CITY, MARYLAND

Miscellaneous Paper No. 2-59

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May 1959

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BEACH EROSION BOARD
OFFICE OF THE CHIEF OF ENGINEERS
Corps of Engineers Wash D.C.

FOREWORD

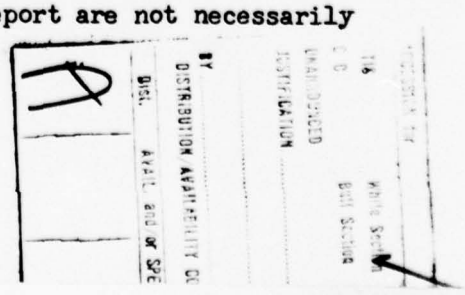
A feature of the general investigations program of the Beach Erosion Board is the assembly of data to facilitate economic selection and employment of materials for use in coastal structures. Earlier reports presented data on durability of steel sheet piling (Technical Memorandum No. 12); on factors affecting the economic life of timber in coastal structures (Technical Memorandum No. 66); and on factors affecting durability of concrete in coastal structures (Technical Memorandum No. 96). There has been limited use of sand-asphalt in coastal structures and field data on performance are too meager to date to compile a report comparable to the scope of the above referenced reports. Forty-three sand-asphalt groins were constructed at Ocean City, Maryland in 1954-55 and the behavior of these structures has been followed since construction. The performance of these structures to date is presented herein with a view that should other experimental work be undertaken on the use of sand-asphalt in coastal structures, these performance data may be utilized for planning and guidance in carrying out the test program.

Publication of the data herein has been made possible through the cooperation of the Maryland State Roads Commission. The Beach Erosion Board is especially indebted to Mr. Walter C. Hopkins, Deputy Chief Engineer and Mr. John D. Bushby, Engineer in charge of prison labor of that commission for supplying and authorizing the use of all construction data, survey data for September 1954 and June 1955, and all photographs taken in October 1955, June 1956, and April 1957. A draft of the report was submitted to Mr. Hopkins for review and comment prior to publication. He in turn submitted it to others interested in the project to obtain their views. The resulting correspondence is appended to this report. In view of the nature of this report, it is published for ~~official use only~~.

This report was prepared by Robert A. Jachowski, Chief, Design Branch, Engineering Division under the general supervision of J. V. Hall, Jr., Chief of the Beach Erosion Board's Engineering Division. Procurement and compilation of field data were accomplished by R. P. Savage, F. Paguirigan, L. L. Watkins, V. E. Dahlin, and H. J. Bruder.

At the time the report was published the technical staff of the Beach Erosion Board was under the supervision of Major General W. K. Wilson, Jr., President of the Board, Colonel Allen A. Futral, Executive, and R. O. Eaton, Chief Technical Advisor. The report was edited for publication by A. C. Rayner, Chief, Project Development Division.

Views and conclusions stated in the report are not necessarily those of the Beach Erosion Board.



BEHAVIOR OF SAND-ASPHALT GROINS AT OCEAN CITY, MARYLAND

By
Robert A. Jachowski, Chief,
Design Branch, Engineering Division
Beach Erosion Board

INTRODUCTION

The ocean shore of Maryland northward from Ocean City to the Delaware State line has had a history of erosion over the past century. In 1954 and 1955 the Maryland State Roads Commission desired to stabilize this shore, and with limited funds available decided to experiment with sand-asphalt construction for a groin system. Figure 1 is an aerial mosaic of the area.

HISTORICAL BACKGROUND

The ocean shore of Ocean City and northward to the Delaware State line, a length of about 9 miles, had a history of recession as indicated by surveys made in 1850 and 1929. Prior to 1933 a system of timber groins had been built to protect the beach in front of the Ocean City boardwalk. In 1933 a severe hurricane caused the formation of the present inlet at the south end of Ocean City. The following year two stone jetties were constructed to stabilize that inlet. Following the construction of these jetties accretion of the shore line occurred north of the north jetty for a distance of about one mile, as shown by surveys of 1942 and 1955. In 1955-56 the north jetty was rebuilt. Although this rebuilding has been expected to increase the length of the accretion area, this effect has not as yet become apparent in available data. The timber groin system was extended until it reached northward to 26th Street by 1951. The general trend of shore recession north of the accretion area as far as 76th Street, from 1942 to 1955 (see table 1), indicated the need of measures for shore stabilization, and led to initiation of construction of the sand-asphalt groin system.

During the period between August and December 1954, thirty-three groins were built at the ends of streets along the 5-mile stretch of beach northward from Ocean City toward the Delaware State line. The following summer five additional groins were similarly constructed to complete the system which resulted in an average spacing between groins of 900 feet. At the same time five groins were placed between the existing structures at various locations (see figure 1), resulting in an approximate spacing of 450 feet in these areas.

TABLE 1

HISTORICAL SHORE LINE CHANGES

	Miles N. of Inlet	1849-50 to 1929 (feet)	1929 to 1942 (feet)	1942 to 1955 (feet)	Net Change (feet)
At North Jetty	0.0				
2 Miles N. of Inlet	2.0	-290	0	0	-290
31st Street	2.5	-200	0	-80	-280
43rd Street	3.2	-100	-50	-50	-200
52nd Street	3.7	-190	0	-80	-270
61st Street	4.3	-100	0	-70	-170
76th Street	5.1	0	-70	-40	-110
91st Street	5.9	-20	-20	+20	-20
112th Street	6.8	+20	-120	+50	-50
Jackson Ave.	7.7	-100	-80	+50	-130
Bennett Ave.	8.6	-150	-10	+20	-140

\+ Accretion
\- Recession

TIDES, WAVES AND STORMS

The tides along the Maryland coast are semidiurnal and have mean and spring ranges of 3.5 and 4.3 feet respectively. The highest storm tide of record in the vicinity was 4.3 feet above mean high water in the Breakwater Harbor area (Cape Henlopen) in August 1933, but a stage about 1 foot higher during the storm of November 1950, when the tide gage was not in use, has been reported. From August 1954 to November 1957 the storms indicated in table 2 have produced not only high surf conditions but also rather high storm surges, that is water levels in excess of the predicted tide level for the time. Northeast storms, as indicated by table 2, have a storm surge slightly less than hurricanes but a duration of days rather than hours. These data indicate that wave action as the result of northeast storms, rather than hurricanes, is more destructive to the beach and shore structures.

No comprehensive statistical study of wave height and direction within the area has been made. Severe wave action occurs as a result of wave fronts approaching the area from the northeast quadrant. It is readily apparent from hydrographic charts that shoal areas offshore and the configuration of the shore line protect the coast from severe wave action except for the sector between N 60° E and due east. Storm wave heights of 15 feet within the breaker zone have been reported. By the use of interpolated statistical data* it was found that almost three-

*Saville, T., Jr., "North Atlantic Coast Wave Statistics Hindcast by Bretschneider - Revised Sverdrup-Munk Method", Technical Memorandum No. 55, Beach Erosion Board, Corps of Engineers, November 1954.

quarters of the offshore deep water waves approach from the direction northeast through east.

There is general agreement among those familiar with storm conditions at Ocean City that, although the predominant winds blowing from offshore are southerly, they are of relatively low velocity. Wind records of the U. S. Weather Bureau at Delaware Breakwater, about 28 miles north of Ocean City, show that the frequency of gales 30 miles per hour or greater from the east is 411 in 100 years and the frequency of such gales from the northeast is 1,315 in 100 years.

Hurricanes and storms listed in table 2 are those which affected the coast in the vicinity of Ocean City during the period between August 1954 and November 1957, producing high tides and high surf conditions. It has been observed that the hurricanes are more severe in intensity but of shorter duration and frequency; while the northeast storms are not quite as intense, but their duration and frequency are greater.

TABLE 2

HURRICANES AND NORTHEAST STORMS

Storm	Date	Maximum Storm Surge* (feet)	Approximate Duration of Storm Surge 1 ft.*
	1954		
Hurricane "Carol"	30-31 August	2.9	42 hours
Hurricane "Edna"	10-11 September	No record	-
Hurricane "Hazel"	15-16 October	2.6	19 hours
Northeast Storm	21-24 October	>1.3	>30 hours
Northeast Storm	13-16 December	1.8	23 hours
	1955		
Northeast Storm	8-11 June	2.6	53 hours
Hurricane "Connie"	12-13 August	2.6	43 hours
Hurricane "Ione"	17-19 August	1.8	16 hours
Northeast Storm	18-20 September	1.8	20 hours
Northeast Storm	13-20 October	3.3	126 hours
Northeast Storm	2- 6 November	1.6	55 hours
Northeast Storm	10-12 November	2.0	17 hours
	1956		
Northeast Storm	4-12 January	>3.0	>5 days
Northeast Storm	11-14 April	2.1	43 hours
Hurricane "Flossy"	25-28 September	3.8	75 hours
Northeast Storm	17-18 October	>1.4	>30 hours
Northeast Storm	24-31 October	>1.7	>8 days
	1957		
Northeast Storm	5- 6 October	>2.6	>5 days

*Storm surges (excess of actual over predicted tidal stages) are for Tide Station at Breakwater Harbor, Cape Henlopen, Delaware.

GROIN CONSTRUCTION PROCEDURE

In general, the groins were patterned after asphalt groins constructed at Wrightsville Beach, North Carolina and Fernandina Beach, Florida. The structures consisted of an apron or foundation and crown or mound extending from the mean low water line to the dunes. The design of the apron of the groins constructed in 1954 provided for a width of 20 feet, decreasing in thickness from 12 inches at the seaward end to 4 inches at the landward end. The apron was constructed on a uniform slope from mean low water to elevation 8.5 feet, thence horizontal, terminating at the dune line. The crown, centered on the apron, was built with a trapezoidal cross section 3 feet high and 8 feet wide at its base, with the top rounded on a 1-foot radius, except in the seaward 35 feet where it was reduced in height and widened to 22 feet at its base. During the construction of the crown, a fillet of material with a 1-foot radius was formed in the angle between the crown and apron.

The design used in the latter part of 1954 incorporated several modifications, dictated by experience gained through the exposure of earlier designs to waves generated by northeasterly storms and hurricanes. These modifications involved a 6-inch reduction in the crown height, a change of the slope of the seaward end from 8 to 5 percent grade and a reduction in the width of the apron from 30 to 20 feet (see figure 2 - type 3). Further modification was made in 1955 following observations of the 1954 structures. Basically the modification involved only a 2-foot reduction of the width of the apron, other than the monolithic placement of the apron and crown (see figure 2 - type 4).

The groins were first built in four stages: the landward apron, the seaward apron, the landward crown, and finally the seaward crown. Later, the number of stages was reduced to two, the apron being constructed throughout the length of the structure and then the crown. Finally, the last ten groins constructed during the summer of 1955 were built in one stage, the apron and crown being placed in one operation (see figure 2 - type 4). Figure 3 shows a few of the steps in the construction procedure of the last ten groins. It should be noted that approximately 50 percent of the height of the crown was placed below the average level of the beach so that the apparent rapid accretion of beach material by the groins was due to construction procedure.

The specifications for the sand-asphalt mix were changed several times in an effort to develop an optimum mix. Initially, the apron material, composed of 12 percent asphalt and 88 percent beach sand, was heated to 300° Fahrenheit when placed in sea water at the seaward end, and to 225° Fahrenheit in the landward end. The crown was composed of material containing 8 percent asphalt and 92 percent beach sand heated to 200° Fahrenheit. As construction progressed, other mixes employing bank sand, slag, and clay were specified. The final mix used contained 9 percent asphalt with 91 percent beach sand, except in the first 100 feet of the seaward end where a coarser bank sand was substituted. The mix was heated to 300° Fahrenheit when placed in sea water and 225°

Fahrenheit when placed on the dry beach. All the sand-asphalt used was of 60-70 penetration paving grade. Approximately 15,000 tons of sand-asphalt mix were used in constructing the forty-three asphalt groins, including repairs and modifications. The average groin, approximately 178 feet in length, contained 332 tons of material, and had an average cost, including administrative and operational charges of $9.87 per ton, or approximately $3,277 per groin.

BEHAVIOR OF BEACH AND GROINS

The evaluation of the effectiveness of the groin construction was based on data obtained from periodic beach and groin profiles, as well as a pictorial record of each of the groins. Profiles were taken in September 1954 (about 1/2 month after construction started), June 1955 (immediately after the completion of the groin system), and October 1957. Photographs were taken in September 1954, September and October 1955, April and June 1956, April and October 1957. The combination of the profiles and photographs provided a comprehensive record of each of the groins. Although data are available for all of the groins, the profiles for every fifth groin northward from 31st Street, shown on figure 4, are representative of the entire system.

In August 1954 the average beach slope at Ocean City was approximately 8 percent from the mean low water line for a distance of nearly 100 feet landward, at which point the beach flattened to about 4 percent to the base of the sand dunes which generally parallel the shore line. Between 18 August and 1 September, four groins were completed. They were observed following the heavy surf conditions of two hurricanes (Edna and Hazel). As a result of these storms considerable undercutting occurred to the seaward 100 feet of the apron, resulting in failures of these structures. The design was changed (see figure 2 - type 2) and the construction of two additional groins was started. However, before these two groins were completed, the design was again changed and this last design was used for thirty-three groins, including the rebuilding of the first six groins (see figure 2 - type 3).

The September 1954 profiles of the 31st Street groin, shown on figure 4, indicated the severe exposure of the groin above the beach level. The 43rd Street groin had not been completed at the time of the survey and the remaining groins indicated on the figure had not been started. Photograph 1, figure 5, shows the breaching type of damage that occurred to the 31st Street groin as the result of the two hurricanes.

By July 1955, thirty-eight of the forty-three groins were completed. The June 1955 profiles on figure 4 provided the first comparative data for the early groins.

An analysis of photographs revealed that in September and October 1955 thirteen of the forty-three groins were barely exposed or not exposed at all in the tidal zone. The remaining groins showed signs of deterioration in three distinct forms: (1) Breaching, that is, the beach had eroded in the tidal zone, leaving a void or gap as seen in photograph 1, figure 5. This breaching varied between 10 and 40 feet in length. (2) End raveling, that is, the seaward end developed cracks as the result of undercutting and settlement, and wave action broke off and carried away the pieces. This type of deterioration is graphically shown in photographs 2 and 3, figure 5. (3) Side raveling, that is, the asphalt broke off one side of the crown or apron as the result of wave action undercutting the side or splitting along the longitudinal temperature cracks in the crown. The apron undercutting type of side raveling is seen in photograph 4, and the crown side raveling is shown in photograph 5, figure 5.

An analysis of the photographs of April 1956 indicated that many of the groins were still exposed, but by June of that year twenty-four groins were covered by sand in the tidal zone; seven were exposed only to a minor degree (less than 6 inches above the beach level, or only a small section in the surf zone, see photograph 6, figure 5); and twelve groins remained completely exposed. These twelve groins that were exposed in the tidal zone showed that deterioration of the end and north side of the groin had continued. Photograph 4 shows the condition of the 40th Street groin during this period. Severe erosion and undercutting is apparent.

By April 1957, thirty-five groins were no longer visible in the tidal zone; three of these groins showed small sections of asphalt in the surf zone at extremely low tide. Only eight groins were partially exposed in this zone. With fewer groins exposed, the actual evaluation of the deterioration became more difficult, other than the fact that not being exposed denoted deterioration, but those exposed continued along the same general trend.

The latest observations were made in October 1957 when profiles and photographs were taken. The photographs indicated that thirty-eight of the groins were not exposed in the tidal zone but four of these groins had minor exposed portions of asphalt only at extremely low tide (-1 foot MLW, see photographs 7 and 8, figure 5). Only five groins were exposed in the foreshore area and these ranged from barely visible to 3 or 4 feet of height exposed above the beach surface. Photograph 9, figure 5, shows the severe exposure of the groin at 76th Street (a comparison of photographs 6 and 9 shows the extent of the erosion to this groin in the 16-month period), whereas photograph 10, figure 5, shows the typical groin that was not exposed in the tidal zone.

A comparison of the groin profiles on figure 4 for October 1957 and June 1955, indicates that in most cases the seaward end had been destroyed or had disappeared below the beach surface. The groins have

progressively settled with a few exceptions from the seaward toward the landward end. In some cases this settlement exceeded 4 feet, thus making the groins ineffective to retain the desired beach width. Data on the condition of the groins in October 1957, summarized in table 3, indicate that only 35 percent of the total length of the groins remained within 1 foot and 40 percent within 2 feet of the June 1955 profiles. A comparison of the beach profiles for September 1954 and October 1957 indicated that there had been a general recession of the high and low water shore lines during this period.

CONCLUDING REMARKS

The historical shore line changes of this stretch of beach showed that a major portion of the groin system was located in an eroding area at the time of its construction. The beach profiles taken in September 1954, June 1955, and October 1957 showed a general recession of the entire shore line as well as a slight increase in elevation of the berm crest.

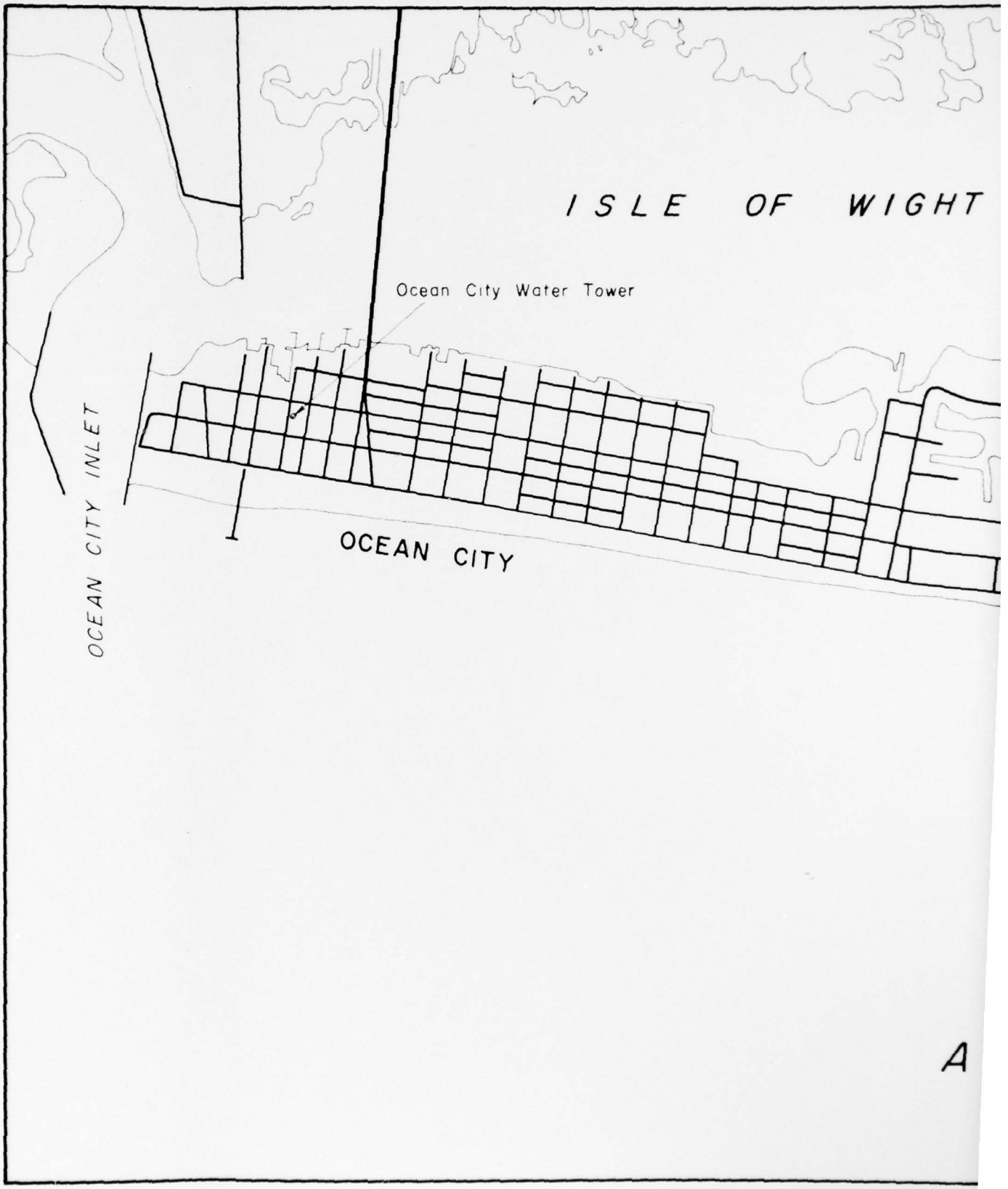
Although the groins were constructed with approximately 50 percent of their height (the highest being $3\frac{1}{2}$ to 4 feet) buried below the beach surface, storm wave profile adjustments caused exposure of the crowns and aprons of the groins. As a result, the groins were undermined and settled or were destroyed. After the storms, the beach slope re-adjusted and covered the seaward section of the groin which had settled. With this portion of the crown covered, the groins were not able to retain littoral material. Three years after construction (October 1957) only five of the forty-three groins were exposed above the beach level in the foreshore zone. The net effect of the entire groin system on the shore at the end of 3 years appears to have been negligible.

The behavior of the sand-asphalt groins of the type used to date demonstrates definite limitations of effectiveness. Modification of design as to mix, dimensions, and sequence of construction may reveal a different behavior.

TABLE 3
GROIN CONDITIONS IN OCTOBER 1957

Groin Location	Length (feet)	Construction Completion Date	Length of Groin within 1' of June 1955 Profile Length (feet)	%	Length of Groin within 2' of June 1955 Profile Length (feet)	%	Remarks
28½ St.	200	11 July 1955	-	-	-	-	Only 1957 profile
31st St.	200	27 Aug. 1954	43	22	49	25	
34th St.	197	26 Aug. 1954	42	21	47	24	
37th St.	173	27 Aug. 1954	29	17	33	19	
40th St.	200	14 Oct. 1954	65	32	70	35	
43rd St.	197	28 Sept.1954	73	37	76	39	
46th St.	217	14 Oct. 1954	114	53	125	58	
47½ St.	160	14 July 1955	-	-	-	-	Only 1957 profile
49th St.	155	6 Oct. 1954	58	37	73	47	
50½ St.	150	15 July 1955	-	-	-	-	Only 1957 profile
52nd St.	143	14 Oct. 1954	9	6	20	14	
53½ St.	168	16 July 1955	-	-	-	-	No profiles
55th St.	179	14 Oct. 1954	-	-	-	-	Only 1955 profile
56½ St.	160	18 July 1955	-	-	-	-	No profiles
58th St.	184	4 Nov. 1954	63	34	67	36	
61st St.	165	4 Nov. 1954	> 75	> 45	-	-	No apparent settlement
64th St.	220	20 Aug. 1954	68	31	74	34	
67th St.	130	25 Oct. 1954	60	46	66	51	
70th St.	176	16 Nov. 1954	43	24	48	27	
73rd St.	178	16 Nov. 1954	50	28	54	30	
76th St.	175	17 Nov. 1954	75	43	76	44	
79th St.	175	17 Nov. 1954	51	29	56	32	
82nd St.	155	18 Nov. 1954	> 75	> 48	-	-	
85th St.	188	26 Nov. 1954	67	36	73	39	
88th St.	178	10 Dec. 1954	36	20	44	25	
91st St.	187	7 Dec. 1954	61	33	67	36	
95th St.	150	27 Nov. 1954	36	24	> 45	> 30	
99th St.	150	30 Nov. 1954	50	33	64	43	
104th St.	150	5 Oct. 1954	61	41	66	44	
108th St.	195	30 Nov. 1954	40	20	-	-	Only 40' located in 1957
112th St.	178	3 Dec. 1954	> 75	> 42	-	-	
116th St.	175	20 Dec. 1954	19	11	61	35	
Cropper Ave.	175	20 Dec. 1954	85	49	90	51	
Miles Ave.	175	17 Dec. 1954	90	51	93	53	Abrupt break at end
Schley Ave.	175	11 Oct. 1954	101	58	> 125	> 72	
Jackson Ave.	186	12 Oct. 1954	81	44	103	55	
Goldsboro Ave.	187	13 Dec. 1954	58	31	77	41	
Island Ave.	183	13 Dec. 1954	88	48	90	49	
Dover Ave.	193	14 June 1955	57	30	67	35	
Blades Ave.	188	15 June 1955	72	38	80	43	
Bennett Ave.	205	16 June 1955	70	34	84	41	
Frankford Ave.	192	17 June 1955	70	36	84	44	
Taylor Ave.	190	18 June 1955	94	49	98	52	
		Average	34.6		39.5		

FIGURES 1 to 5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Ocean City Water Tower
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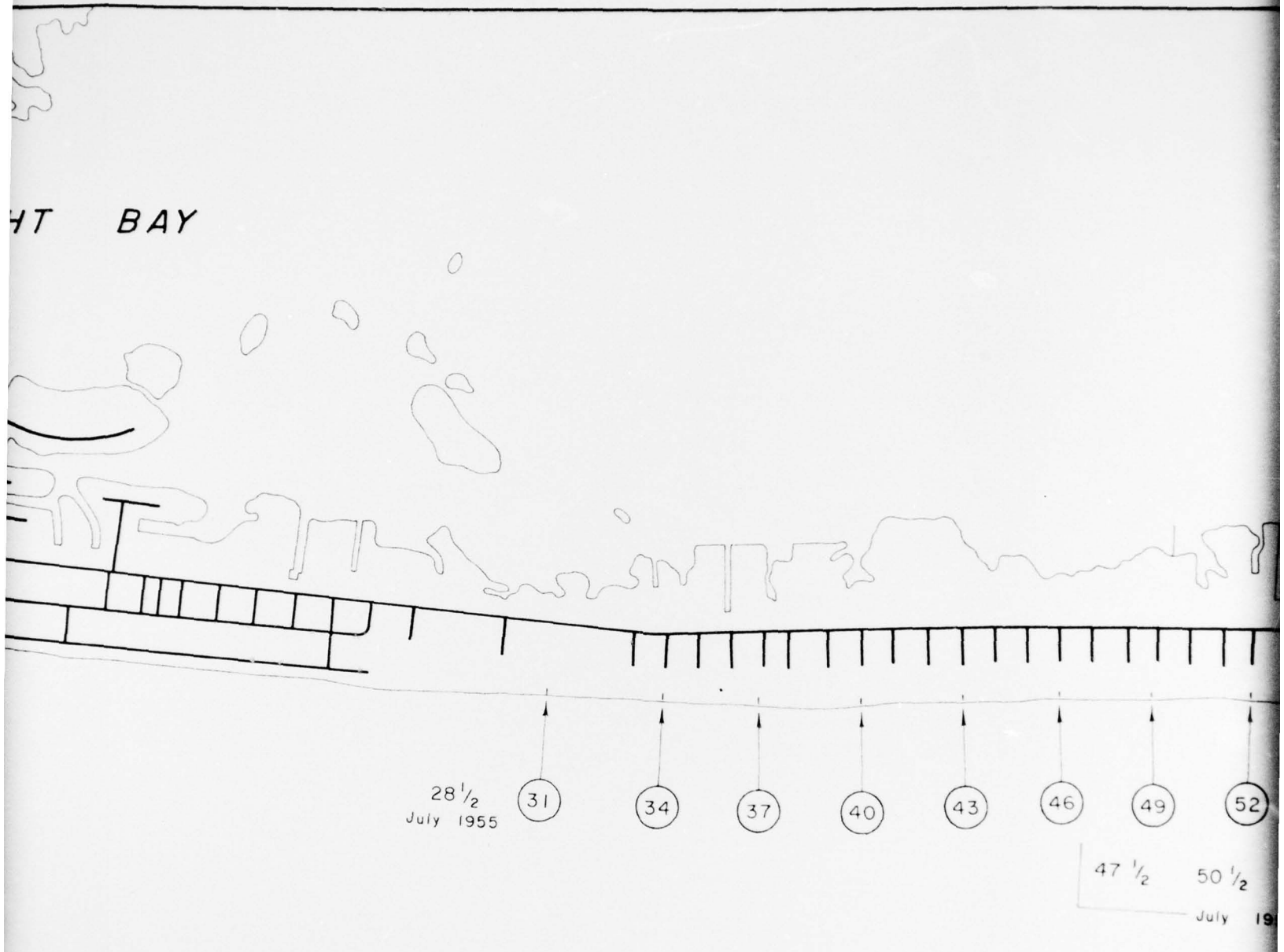

A T L A N T I C


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July 1955
OCEAN

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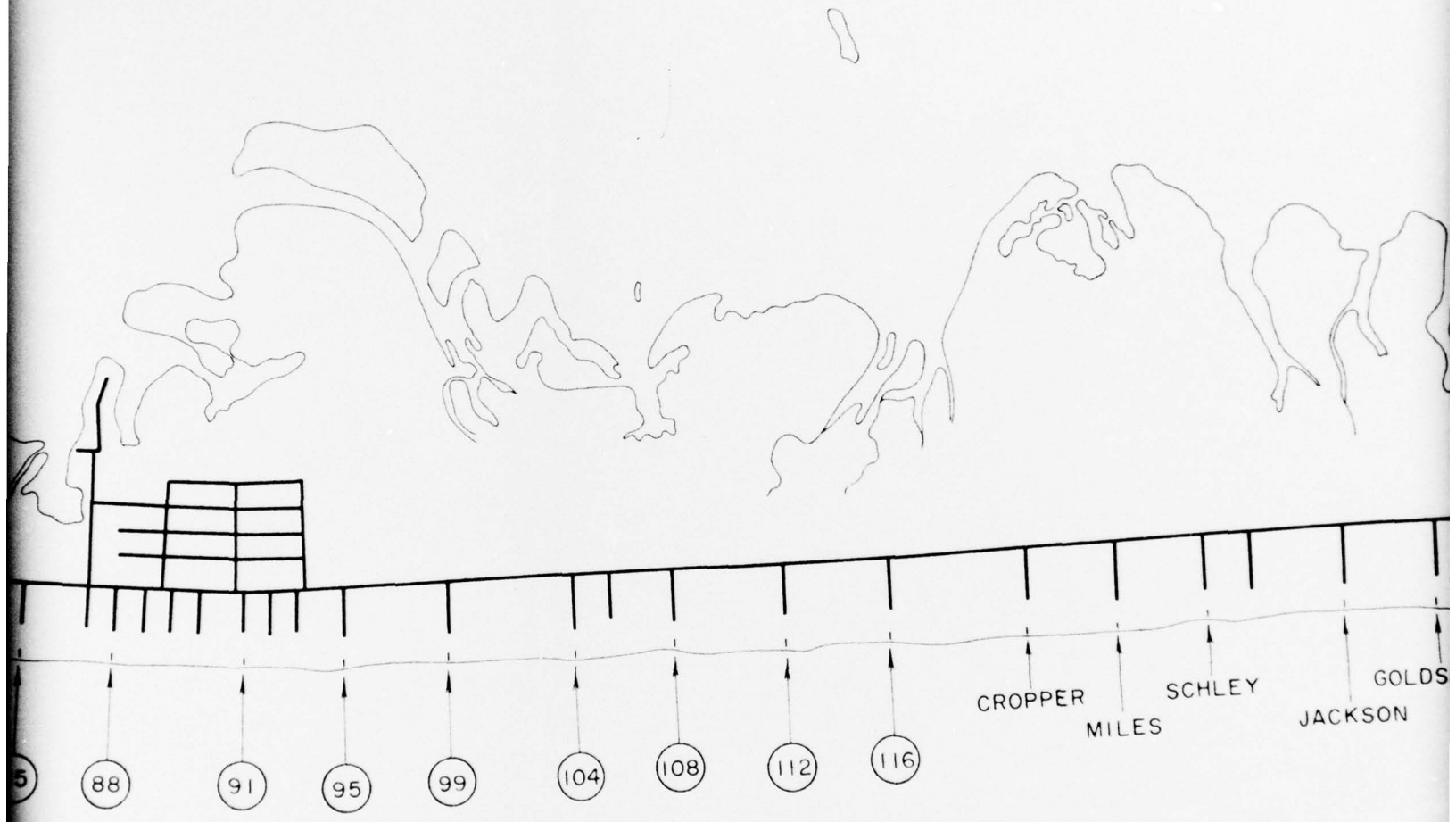
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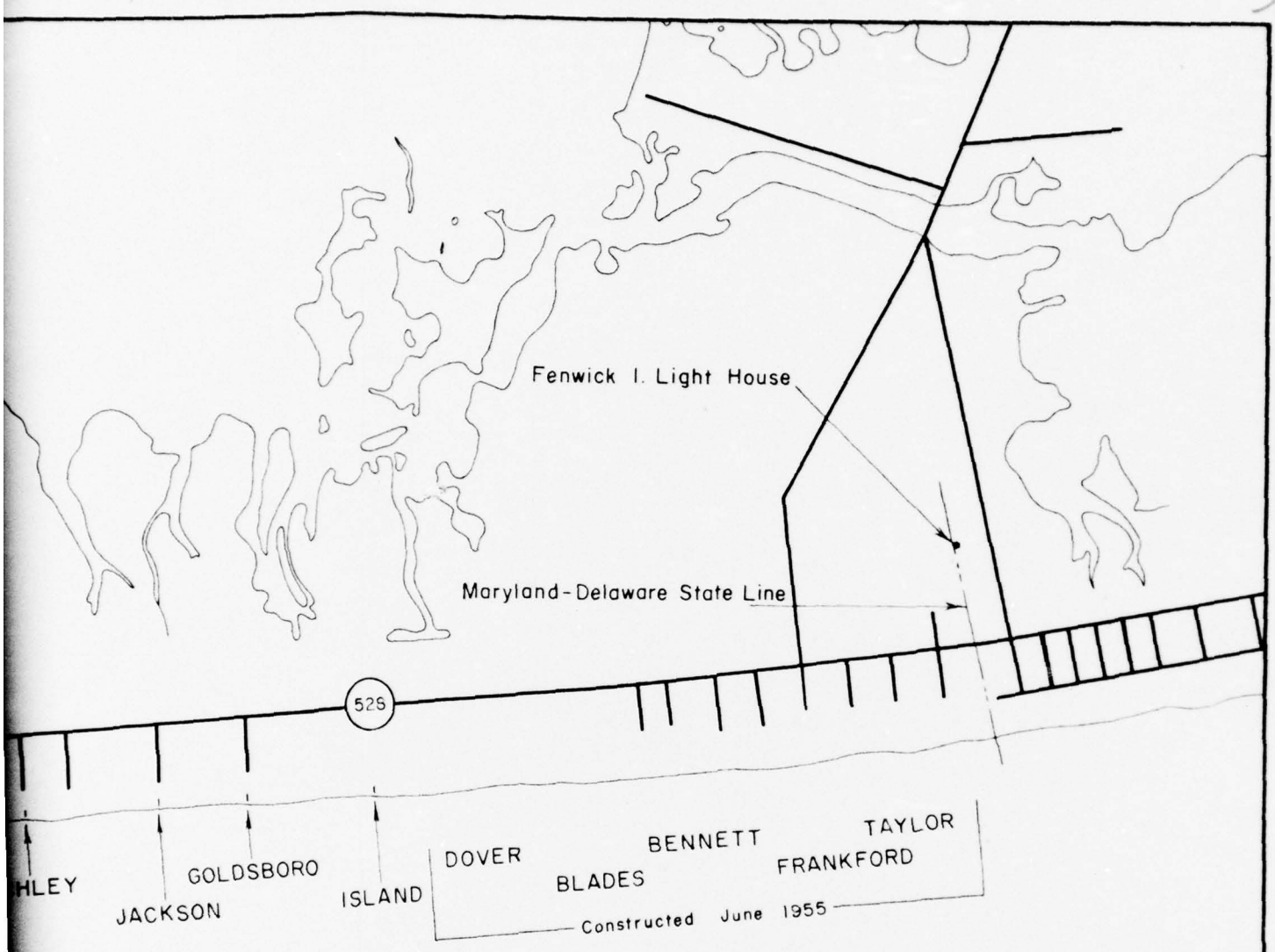
CROPPER
MILES
SCHLEY
JACKSON
GOLDS



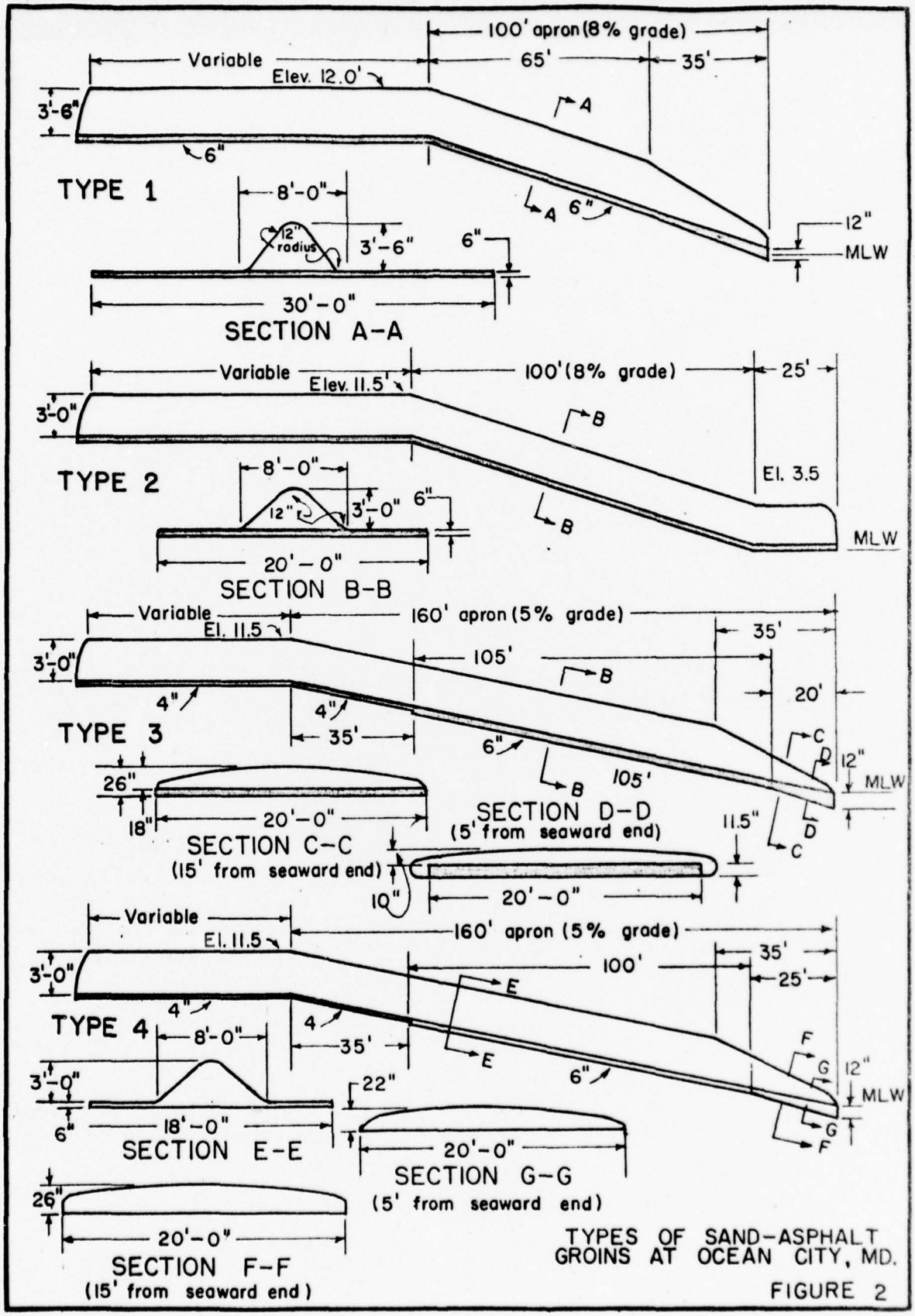
ASPHALT GROINS AT OCEAN CITY, MARYLAND

From U.S.C.&G.S. Air Photo — 14 March 1955

SCALE IN FEET

1000 0 1000 2000 3000

FIGURE 1.



TYPES OF SAND-ASPHALT GROINS AT OCEAN CITY, MD.

FIGURE 2

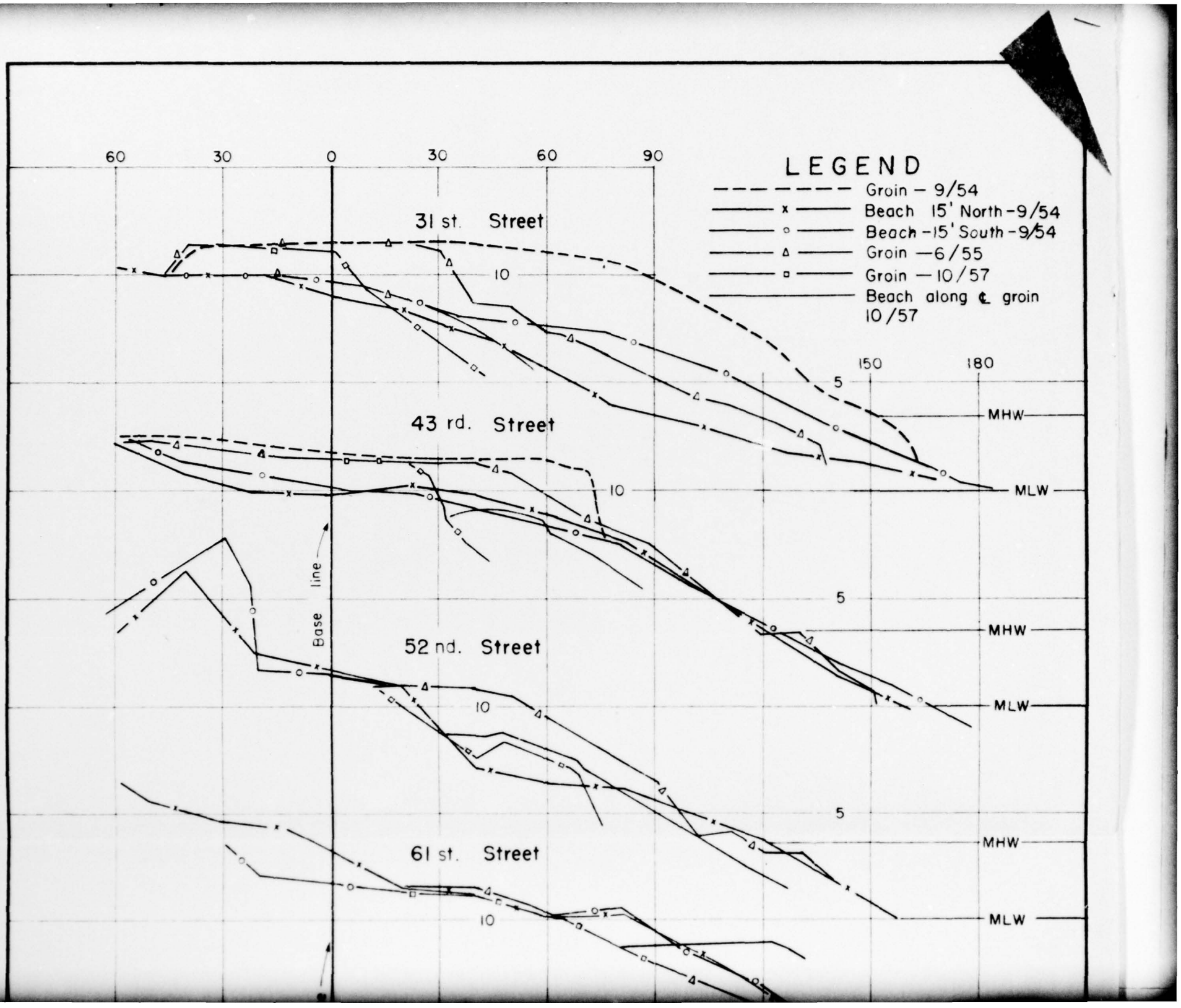
Building sand dike during initial excavation.

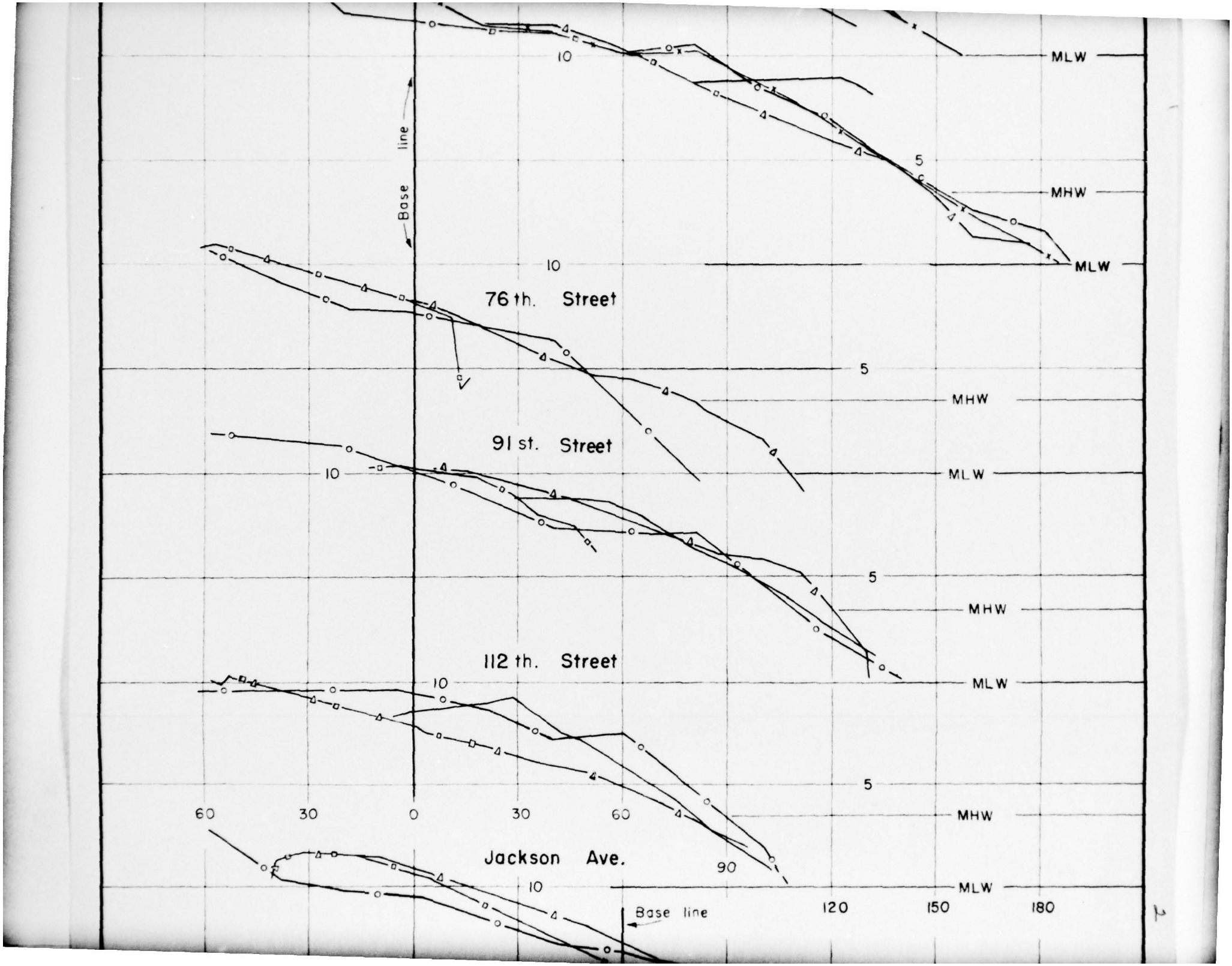
Grade prepared. Ready for hot sand – asphalt mix.

Apron and crown constructed in one operation. Crown shaped by hand.

Hand shaping and smoothing with back of shovel. Groin terminated at sand dune.

SAND – ASPHALT GROIN
CONSTRUCTION PROCEDURE
SUMMER 1955
FIGURE 3


LEGEND
Groin – 9/54
Beach 15' North – 9/54
Beach – 15' South – 9/54
Groin – 6/55
Groin – 10/57
Beach along ℄ groin 10/57
60
30
0
30
60
90
150
180
31 st. Street
43 rd. Street
52 nd. Street
61 st. Street
10
5
MHW
MLW
Base line


MLW
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76 th. Street
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112 th. Street
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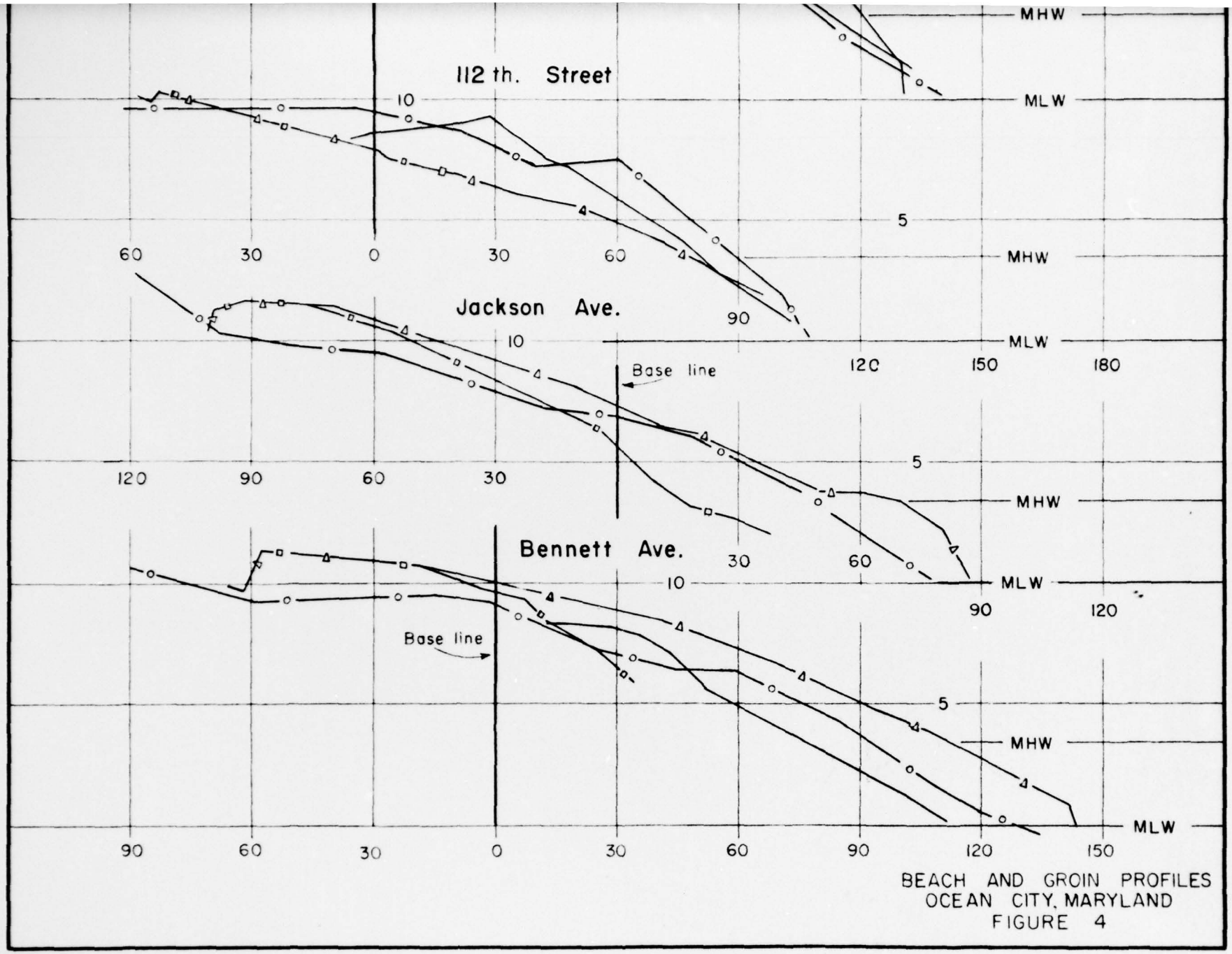

BEACH AND GROIN PROFILES
OCEAN CITY, MARYLAND
FIGURE 4

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE

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Ocean City, Maryland
Sand-asphalt groins

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

Report discusses the construction of 43 sand-asphalt groins at Ocean City, Maryland, in 1954-55, and their behavior has been monitored since construction. The performance of the structures is discussed with a view that should other experimental work be undertaken on the use of sand-asphalt in coastal structures, these performance data may be utilized for planning and guidance in carrying out the test program.

Forty-three were constructed

099 320

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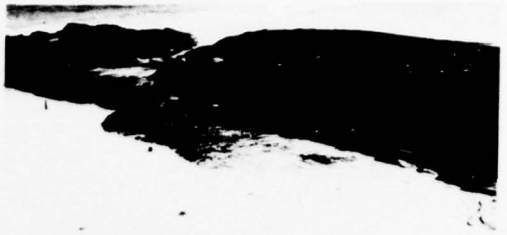
1
31st Street
Sept. 1954



2
31st Street
Oct. 1955

3
52nd Street
Oct. 1955

4
40th Street
July 1956

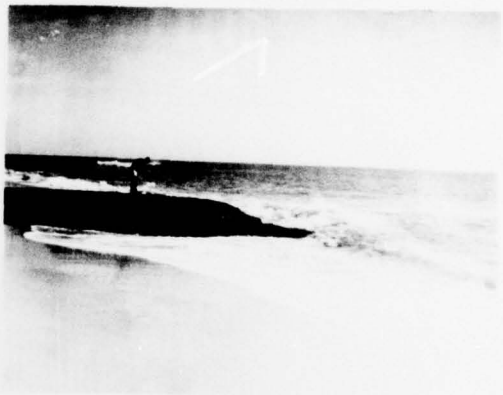
5
46th Street
Sept. 1955

SAND-ASPHALT GROINS
OCEAN CITY, MD.
FIGURE 5

6
76th Street
June 1956

7
58th Street
Oct. 1957

8
95th Street
Oct. 1957



9
76th Street
Oct. 1957

10
Bennett Ave
Oct. 1957

SAND-ASPHALT GROINS
OCEAN CITY, MD
FIGURE 5

APPENDIX

Correspondence

CORPS OF ENGINEERS, U. S. ARMY
BEACH EROSION BOARD
Washington 16, D. C.

ENGBE 30 September 1958

Mr. Walter C. Hopkins
Deputy Chief Engineer
Maryland State Roads Commission
108 East Lexington Street
Baltimore, Maryland

Dear Mr. Hopkins:

In accordance with your agreement with Mr. Robert Jachowski of the Board's staff, the inclosed copy of a proposed technical memorandum on the behavior of the sand asphalt groins at Ocean City, Maryland is submitted for your review and comment prior to publication.

Please feel free to make any changes you consider to be desirable including the addition of other factual data you may have which might add to the value of the paper.

Your cooperation in making the data collected by your organization available to the Board for inclusion in the paper is appreciated. If we can be of service to you at any time please let us know.

Sincerely yours,

1 Incl.
Paper "Behavior of Sand-Asphalt Groins at Ocean City, Maryland"

/s/ ALLEN A. FUTRAL
Colonel, CE
Executive

State of Maryland
STATE ROADS COMMISSION
108 East Lexington Street
Baltimore 3, Md.

November 19, 1958

Col. Allen A. Futral
Corps of Engineers, U.S. Army
Beach Erosion Board
5201 Little Falls Road, N.W.
Washington, D.C.

Dear Col. Futral:

Upon receipt of your letter of September 30, 1958 and copy of proposed technical memorandum on the behavior of sand asphalt groins at Ocean City, Md., for which we are most appreciative, the following procedure was followed.

I wrote Mr. J. O. Izatt who had been Chairman of The Asphalt Institute, Project Committee No. 6 on "Asphalt in Hydraulic Works." Copy of my letter to Mr. Izatt is enclosed, and contains briefly my comments on the report by your Board. My reason for presenting the report for Mr. Izatt's review was the interest of his Committee several years ago, after the groins were completed, and the desire of that Committee to record pertinent factors and consider further studies and research related to materials, design and construction which could be helpful in producing a more satisfactory type of structure. Mr. Izatt, because of his interest in the Ocean City project, has very generously outlined his thinking in his letter to me of November 6, 1958, copy of which is enclosed.

At my request, the report was forwarded to The Asphalt Institute for review, and comments made by Mr. Dillard D. Woodson, Staff Engineer, are presented in his letter of November 10, 1958, copy of which is attached.

After you have reviewed the enclosed file, and should you care to discuss the matter further, I will be glad if you will write me.

Very truly yours,

/s/ Walter C. Hopkins
Deputy Chief Engineer

Attachments

State of Maryland
STATE ROADS COMMISSION
108 East Lexington Street
Baltimore 3, Md.

October 3,1958

Mr. J. O. Izatt
Shell Oil Company
50 West 50th Street
New York 20, New York

Dear Mr. Izatt:

You will recall our conversation on the evening of October 15, at LaSalle, Illinois concerning a paper which has been assembled by the Beach Erosion Board on the "Behavior of Sand-Asphalt Groins at Ocean City, Maryland."

During our conversation, I recited very briefly the history and thinking on the part of this Commission at the inception of the installation of this type structure. The effort intended to be accomplished was the maintenance of the beach in the condition and position as of the construction date.

I am somewhat concerned with the paper which I am enclosing for your review. Our thinking of the installation of the asphalt groins was, as I have just mentioned, to attempt to maintain the beach with no consideration in the design of the structures for accretion.

Another point that should be considered is the material contained in the structures. The beach sand at Ocean City is rounded, on the course side, and of more or less uniform gradation containing very few fines and therefore representing a rather unstable material. There was also a very meager background on the type and quantity of asphalt that could be used most effectively and this point should be given very careful consideration in the preparation of a report such as the Beach Erosion Board has under consideration at the present time.

In conclusion, I would say that any comment should consider the intended purpose of the installation which was with no thought of aggressive action in attempting to provide accretion. Secondly, I think the meager installations as far as materials are concerned, should be fully presented. I am quite sure, in the years to come, well performing structures of this type and of similar material will provide successful and adequate installations at very reasonable cost.

I hope you will have the opportunity to give this matter your careful consideration so that comments can be furnished the Beach Erosion Board for their use prior to the final preparation of the paper.

Very kind personal regards,

Sincerely,

/s/ Walter C. Hopkins
Deputy Chief Engineer

Attachment

SHELL OIL COMPANY
50 West 50th Street
New York 20, N. Y.

November 6, 1958

File: 509.5

Mr. Walter C. Hopkins
Deputy Chief Engineer
State of Maryland Roads Commission
108 East Lexington Street
Baltimore 3, Maryland

Dear Mr. Hopkins:

We have read the report entitled "Behavior of Sand Asphalt Groins at Ocean City, Maryland", by Mr. Jachowski, Chief Design Branch, Engineering Division of the Beach Erosion Board which was attached to your letter of October 23, 1958, addressed to our Mr. J. O. Izatt. Mr. Izatt is no longer Chairman of The Asphalt Institute, Project Committee No. 6 on "Asphalt in Hydraulic Works", a position which he held for several years, and which placed him in close contact with the construction and early life of these groins. This has not diminished our interest in this project, and it was disturbing to read this report. Perhaps a more favorable reaction would result if the original intent and the engineering evolution if these groin structures were again reviewed with the Beach Erosion Board.

The engineering measurements and statistical data in the report showed that a general build-up of the beach has not been experienced. The same data do not clearly show that groins have been ineffective in maintaining and arresting the recession of the beach, which we understood was the principal objective. In our opinion, performance of the groins for these latter purposes should be more carefully evaluated.

Aside from the physical benefits to the beach, we feel that the engineering experiences with these groins are pointing the way toward improvements and we share your confidence that structures of this type can be constructed to give an entirely satisfactory performance at reasonable costs.

We have also observed the distress in some of these groins as evidenced by (1) settlements, (2) sloughing and cracking, and (3) erosion by water, and have studied these imperfections for improvements in (1) geometrical and hydraulic shape, (2) construction practices, and (3) asphaltic mix designs. There are many encouraging possibilities. There is ample evidence as set forth in publications, notably one entitled "Bitumen in Hydraulic Engineering" by Baron W.F. van Asbeck of Shell Petroleum Company, that asphaltic mixes properly designed and properly placed in the correct hydraulic configuration will withstand the most severe of ocean storms indefinitely.

With the experiences gained at Ocean City as a background, obvious improvements can now be made in the preparation of the asphaltic mixes. A report, No. B-24, dated August 1957 by the Bituminous Laboratory of the U.S. Bureau of Reclamation, suggests some ways. Their comparative data on asphaltic mixes show those which are able to resist (1) impact, (2) water erosion, and (3) negative pressures in a laboratory wave machine.

Smooth oval shapes are indicated so the groins will gradually dissipate the energy from the waves, and at the same time gradually check the velocities of the water so the sand will be dropped out. Construction procedures from the operation of the hot-plant to the placing and shaping of the groin must be carried out to achieve uniformity in composition and proper consolidation of the structure. Thence tough asphaltic mastics prepared from selected aggregates, mineral fillers, and with appreciably high asphalt contents are indicated for resisting the stresses observed in these groins.

With these factors in mind, we feel that the asphaltic groin can be immeasurably improved and still be low in cost, which is one of its attractive features. The Asphalt Institute Project Committee have prepared tentative specifications along these lines which may be helpful, and which are available for exploratory considerations.

Because of the widespread interest in the Ocean City groins, we are passing this report along to The Asphalt Institute for their comments, as explained in our telephone conversations with you this date. We are sure that they are willing and able to provide an engineering analysis of these data. Please let us know when we can be of further assistance in this matter.

Yours very truly,

/s/ J. O. Izatt
For: H. R. Kemmerer, Manager
Products Application Department

THE ASPHALT INSTITUTE
Executive Offices and Laboratories
University of Maryland
College Park, Maryland

November 10, 1958

Mr. Walter C. Hopkins
Deputy Chief Engineer
State of Maryland Roads Commission
108 East Lexington Street
Baltimore 3, Maryland

Dear Mr. Hopkins:

The report entitled "Behavior of Sand-Asphalt Groins at Ocean City, Maryland" prepared by Mr. Jachowski, Chief Design Branch, Engineering Division of the Beach Erosion Board, was forwarded to us by Mr. J. O. Izatt, Shell Oil Company, along with a copy of his comments to you on the report.

I have reviewed both the report and Mr. Izatt's comments very carefully and I would like to state that the report is also most disturbing to me.

It seems to me that there is a misconception by the Beach Erosion Board of the intended use of these groins. Certainly it was never intended that the groins would build up the beach. The primary intent was to maintain the beach in the condition it was at the time of construction. This has been accomplished by these groins.

Mr. Izatt has clearly pointed out the many discrepancies in the report so I will not reiterate them in my letter. I think that these points should be presented to the Beach Erosion Board and ask that they be considered before final publishing of the report.

I would also like to advise that The Asphalt Institute's Committee on Hydraulics is still studying the groin problems and hope that some developments will soon be forthcoming.

If we can be of any assistance to you in presenting information to the Beach Erosion Board, please feel free to call on us at anytime.

Yours very truly,

/s/ Dillard D. Woodson
Staff Engineer

DDW:ig

Enclosure